

INTERNAL USB DRIVE HOUSING BAY

BACKGROUND OF THE INVENTION

1. Technical Field

[0001] The present invention relates in general to the field of computers, and in particular to coupling external devices, such as disk drives, to a computer. Still more particularly, the present invention relates to a method and system for connecting an external device to an internal Universal Serial Bus (USB) port.

2. Description of the Related Art

[0002] In response to computers becoming more modular, a Universal Serial Bus (USB) interface standard was jointly developed in the 1990's by Intel Corporation, Microsoft Corporation, Compaq Computer Corporation, Digital Equipment Corporation, Northern Telecom Limited, NEC Corporation, and International Business Machines, Inc. The USB standard defines a high-speed serial data interface between a computer and add-on devices, such as keyboards, printers, scanners and secondary storage devices, including floppy disk drives, hard disk drives, and solid-state secondary storage drives. In computers that have USB compliant ports, such devices can be added or removed while the computer is powered up and running.

[0003] With the growing popularity of portable computing devices having USB compliant ports, such as laptop (notebook) computers, tablet computers, and personal digital assistants (PDA's), the USB ports afford on-the-go flexibility to a user/owner of the portable computing device. That is, the user of a laptop computer can carry multiple external peripheral devices such as described above, and simply plug the needed external peripheral device into the portable computing device when needed.

[0004] A typical portable computing device is illustrated in **Figure 1** as computer **100**. Computer **100** includes a base **102**, to which is attached a display **104** with a display hinge **106**. At the back of computer **100** is a USB port (female) **108**, which is capable of receiving a USB plug (male) **110**. USB plug **110** connects an external cable **114** to exemplary USB storage

device 112, a common external peripheral device, which may be a mechanical hard drive or a solid-state disk.

[0005] By being able to freely connect and disconnect the secondary storage to and from the computer, the user is able to store and share large amounts of data. However, because these secondary storage devices are so easily removed and are typically small, they are often misplaced or stolen.

[0006] Also, being attached externally, all such external peripheral devices are prone to damage when the computer is moved. That is, it is common for the user to forget that the external peripheral device is attached to the back of the laptop, and when the laptop is picked up, the secondary storage device is dropped or otherwise damaged.

[0007] What is needed, therefore, is a method and device that allows a peripheral device, such as a USB compatible storage device, to connect to a computer while minimizing the potential of the peripheral device being lost or stolen.

SUMMARY OF THE INVENTION

[0008] The present invention is therefore directed to a method and system for internally connecting a Universal Serial Bus (USB) device to a computer. An access door, hinged within a computer case, has a USB port attached to an interior of the door. To connect the USB device, the access door is swung open at an angle, the USB device is slid into the interior of the door to mate with the USB port, and the access door is then closed flush with the computer case. The access door allows any USB device, small enough to fit inside the access door, to be removably attached to the interior of the computer, thus reducing the potential of the USB device being lost or stolen.

[0009] In a preferred embodiment, the access door has an electronic lock, which can be unlocked only by inputting a special code from the computer's keyboard or other input device.

[0010] The above, as well as additional objectives, features, and advantages of the present invention will become apparent in the following detailed written description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objects and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, where:

[0012] **Figure 1** depicts a prior art computer having an external Universal Serial Bus (USB) port;

[0013] **Figure 2a** illustrates the present invention having an internally mounted USB port and device;

[0014] **Figure 2b** depicts a USB software hierarchy as used by the present invention;

[0015] **Figures 3a and 3b** illustrate additional detail of an access door used to access and secure the internally mounted USB device;

[0016] **Figures 4a – 4c** depict details of an electronic lock for securing the access door; and

[0017] **Figure 5** depicts a preferred data processing system used by and to control the present invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

[0018] With reference now to **Figure 2a**, there is depicted a computer **201** incorporating novel features of the present invention. A base **200** has a base external surface **214**, shown in **Figure 2** as the bottom surface of base **200**. Inside base **200** is an internal Universal Serial Bus (USB) cable **202**, connecting an internal USB female port **204** to a Southbridge chipset (not shown) or analogous input/output bus in computer **201**. Internal USB female port **204** is configured to receive an internal USB male connector **206** of an internally mounted USB device **208** as shown. The USB devices (**202**, **204**, **206**, **208**) preferably comply with USB Standard Revision 2.0 (or subsequent revisions), published April 27, 2002 by Compaq Computer Corporation et al., which is herein incorporated by reference in its entirety.

[0019] Referring now to **Figure 2b**, there is illustrated a block diagram of software utilized by the present invention's USB environment. Hierarchically below a client application **250** and an operating system **252** is a bootcode BIOS **254**, which is loaded by computer **201** at startup. Bootcode BIOS **254** includes a USB host controller driver **260** that provides a low-level interface to USB host controller **262** (i.e., the hardware within computer **201** that sends and receives data to and from the USB port **204**). In addition, the bootcode BIOS **254** includes a USB system software **258**, which provides a mid-level interface to USB host controller driver **260**. When loaded by the startup program (not shown), bootcode BIOS **254** may also include generic USB device drivers **256** for certain USB devices, such as internally mounted USB device **208**.

[0020] Referring again to **Figure 2a**, internally mounted USB device **208** is secured to a USB access door **210**, which when closed, is flush with base exterior surface **214**. By mating flush with base exterior surface **214**, USB access door **210** allows the user to add a device without changing the external geometry of computer **201**.

[0021] Additional details of USB access door **210** are shown in **Figures 3a** and **3b**. As depicted in **Figure 3a**, USB access door **210** is hinged to an interior surface of base **200** by access door hinges **312**. Access door hinges **312** permit USB access door **210** to travel outwardly away from base **200** at an angle that allows internally mounted USB device **208** to be removed or inserted as

shown. In a preferred embodiment, USB access door **210** includes a lip **310a** that mates against a base stop **310b** such that the closing travel of USB access door **210** ends when USB access door **210** is flush with base exterior surface **214**.

[0022] In a preferred embodiment, also attached to USB access door **210** is a switch engager **304**, which engages a USB turn-on switch **306** when USB access door **210** is closed. USB turn-on switch **306** passes a disabling signal to USB host controller **262** (shown in **Figure 2b**) when USB access door **210** is open. When USB access door **210** is closed, USB turn-on switch **306** is turned off, thus removing the disabling signal, and allowing internally mounted USB device **208** to function normally. USB turn-on switch **306** provides an additional assurance that USB access door **210** is properly closed, to prevent damage to both USB access door **210** as well as internally mounted USB device **208**.

[0023] With reference to **Figure 3b**, note that securement clips **302** are of sufficient dimensions to allow different sized internally mounted USB device **208** to be secured to USB access door **210**. That is, different internally mounted USB devices **208** that fit under the securement clips **302** can be interchanged on USB access door **210** for mating with USB port **204**. This is a significant improvement to prior art systems that permitted an interchange of components (such as a hard drive and a floppy disk drive) into a same orifice of a computer, but only if the different components each had the same geometry to fit into the orifice. While not shown, it is understood that securement clips **302** may be slidably adjustable in order to accommodate different sized USB devices **208**.

[0024] As shown now in **Figure 4a**, in a preferred embodiment USB access door **210** includes a means of being internally locked. An attaching member **404**, shown in greater detail in **Figure 4b**, has a lateral extension **414** as shown. When USB access door **210** is closed, attaching member **404** inserts into an opening **412** of a receiver **410** of an electric lock **402**, as seen in greater detail in **Figure 4c**. To lock electric lock **402**, a signal is sent to an actuator **406**, which moves a force transmitting member **408** to position receiver **410** such that receiver **410** secures and prevents movement of attaching member **404**, which has been inserted into opening **412** when USB access door **210** closed.

[0025] To unlock electric lock 402, an unlocking signal is sent to actuator 406 to move receiver 410 to a position that allows attaching member 404 to exit through opening 412. The locking and unlocking signals are controlled through software in computer 201, in any manner known to those skilled in the art of electronic controls. Preferably, the software permits locking and unlocking only when a code is entered into computer 201. This code, which may be prompted for entry by a drop-down menu, pop-up window, or any other graphical user interface (GUI) for prompting an input from a keyboard, mouse, or other input device, may be the same or different for locking and unlocking electric lock 402. In the event of a software or electrical failure, a back-up means of entry (e.g., an overriding mechanical lock, a set-screw having an unorthodox head inset design, etc.) may be provided to open USB access door 210.

[0026] With reference now to **Figure 5**, there is depicted a block diagram of a preferred embodiment of hardware 500, within computer 201, used to implement the present invention. Hardware 500 is used to run all software described in **Figure 2b**.

[0027] Hardware 500 includes a processor 502, which is connected to a system bus 508. In the exemplary embodiment, data processing system 500 includes a graphics adapter 504 also connected to system bus 508, receiving information for display 506.

[0028] Also connected to system bus 508 are system memory 510 and input/output (I/O) bus bridge 512. I/O bus bridge 512 couples I/O bus 514 to system bus 508, relaying and/or transforming data transactions from one bus to the other. Peripheral devices such as nonvolatile storage 516, which may be a hard disk drive, floppy drive, a compact disk read-only memory (CD-ROM), a digital video disk (DVD) drive, or the like, and input device 518, which may include a conventional mouse, a trackball, or the like, is connected to I/O bus 514. The software described for controlling electronic lock 402 in **Figure 4** is preferably stored in both system memory 510 and nonvolatile storage 516. Finally, the USB port 204 described in **Figure 2** et seq. is connected to I/O bus 514 via internal USB cable 202. In an alternate preferred embodiment, computer 200 utilizes a Northbridge/Southbridge architecture (not shown), in which USB port 204 is supported from the Southbridge chipset.

[0029] The exemplary embodiment shown in **Figure 5** is provided solely for the purposes of explaining the invention and those skilled in the art will recognize that numerous variations are possible, both in form and function. For instance, hardware **500** might also include a sound card and audio speakers, and numerous other optional components. All such variations are believed to be within the spirit and scope of the present invention.

[0030] It should be understood that at least some aspects of the present invention may alternatively be implemented in a program product, preferably performing the functions of the present invention in an automatic manner based on pre-determined criteria as described, including relative logical relationships between and among logic areas. Programs defining functions on the present invention can be delivered to a data storage system or a computer system via a variety of signal-bearing media, which include, without limitation, non-writable storage media (e.g., CD-ROM), writable storage media (e.g., a floppy diskette, hard disk drive, read/write CD ROM, optical media), and communication media, such as computer and telephone networks including Ethernet. It should be understood, therefore in such signal-bearing media when carrying or encoding computer readable instructions that direct method functions in the present invention, represent alternative embodiments of the present invention. Further, it is understood that the present invention may be implemented by a system having means in the form of hardware, software, or a combination of software and hardware as described herein or their equivalent.

[0031] While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.